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Corrigendum

Corrigendum to "Spontaneous rotational symmetry breaking and roton like excitations in gauged σ-model at finite density" [Phys. Lett. B 581 (1–2) (2004) 82]

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The analysis of the equation of motions (18)–(20) in Ref. [1] was concentrated on the regime with $g^4(m) \ll \lambda \ll 1$, where $g(m)$ is the SU(2) running coupling related to the scale m (with m being a mass of the scalar field) and λ is the self-interaction coupling constant of the scalar field. In this regime, as argued in the paper, the contributions of both gauge boson and scalar loops are small and, additionally, there is no Coleman–Weinberg mechanism. In Ref. [1], it was additionally assumed that $g^2 \leq 8\lambda$, which is clearly consistent with the above regime. The regime $g^2 > 8\lambda$ was not analyzed, however, because it was incorrectly suggested that, in this case, the effective potential is unbounded from below.

The physical effective potential is in fact bounded from below. The corresponding correct expression for the potential is obtained after satisfying the Gauss law in Eq. (19). After expressing the zero component of the gauge field from this constraint, we obtain the following expression for the effective potential:

$$V_{\text{phys}} = -\frac{4|C|^2\mu^2\varphi_0^2}{4|C|^2+\varphi_0^2} + \left(m^2 + \frac{g^2|C|^2}{2}\right)\varphi_0^2 + \lambda\varphi_0^4. \tag{1}$$

As is easy to check, this is indeed bounded from below for any choice of the coupling constants g and λ. Moreover, this is a reliable effective potential in the regime $1 \gg g^2 > 8\lambda \gg g^4$, where quantum loop corrections are still negligible. The ground state solutions, found in the paper, appear to be valid in a wider region of coupling constants.

References

[1] V.P. Gusynin, V.A. Miransky, I.A. Shovkovy, Phys. Lett. B 581 (2004) 82.

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